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Psychological Consequences of Environmental Degradation

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Abstract

Psychological aspects of environmental degradation in Burkina Faso are studied among two groups of Sahel dwellers, namely the Mossi (agriculturalists, $n = 402$) and the Fulani (pastoralists, $n = 160$). Compared to pastoralists, agriculturalists were more stressed and marginalized, the psychological consequences of degradation studied here. Men in both groups scored higher on marginalization and lower on stress than women did. Modern attitudes led to more stress and marginalization. Status in the community was unrelated to stress and marginalization. Locus of control and problem-focused coping were related to marginalization but not to stress. A MIMIC (Multiple Indicators, Multiple Causes) model was fitted to the data postulating the relationship among four input variables (culture, environmental degradation, cattle and modernity), a latent variable (called *carrying capacity*) and two output variables (*stress* and *marginalization*). For both men and women an adequate fit was found, with slightly different parameter values for the two sexes.

Keywords

*environmental degradation,
marginalization, Sahel, stress*

SEVERAL INTERRELATED PROCESSES affect the living conditions in the Sahel countries. Most important are westernization (Berry & Kim, 1988; Von Laue, 1987) and increased pressure on scarce natural resources, causing environmental degradation. The latter consists of various related processes such as the deterioration of soil structure, the loss of nutrients and the reduction of biomass (e.g. number and species of wildlife) (Kessler & Laban, 1994; Van Keulen & Breman, 1990). If not reversed, environmental degradation may lead to the complete loss of the primary sources of food and income of the local people. It is remarkable that even though in many developing countries environmental degradation is a major stressor that has far-reaching consequences for various cultural groups, its psychological aspects have not been studied.

Acculturation refers to the changes in an individual who is exposed to a new culture as a result of rapid cultural change or migration. Berry defines four types of attitude to cope with these changes: integration, separation, assimilation and marginalization (e.g. Berry, Poortinga, Segall, & Dasen, 1992). The four types are formed by combining two questions with yes-no responses. The first considers the relationship with the original culture: Does the individual who is acculturating, want or is the individual able to retain positive attitudes towards his or her original culture? The second question considers the same issue vis-à-vis the new culture. Integration is the acculturation style in which positive attitudes with both the old and new culture are sought. It is often associated with a bicultural identity; elements of both cultures are combined in the attitudes and behaviour of the acculturating individual. Separation means that the old way of life is maintained with only superficial contact to the new culture. Individuals who opt for an assimilatory style establish good relationships and a positive attitude towards the new culture while the ties with the original culture are lost; they abandon their traditional way of life and fully adapt to the new culture. Finally, marginalization is the acculturation style in which positive relationships with neither culture are sought. Marginalization, the acculturation style of interest in the present study, is characterized by little or no interest in or opportunity of cul-

tural maintenance (often because of enforced cultural loss), and little or no interest in establishing or maintaining relations with members of the host culture (often for reasons of exclusion or discrimination). According to Stonequist (1935), marginality amounts to being 'poised in psychological uncertainty between two worlds' (p. 12). Marginalization amounts to culture loss. It can occur in the context of rapid cultural change when new and serious challenges have to be met such as environmental degradation or the breakdown of social institutions. Neither the old culture nor the new, often western culture, is seen as providing the tools to cope with the problems.

Processes of both degradation (Blaikie & Brookfield, 1987) and acculturation (Berry, et al., 1992) are accompanied by stress. Cross-cultural investigations have reported various consequences of stress. Marginalization leads to a higher and more enduring stress level than the other acculturation styles do; it is probably better viewed as a state of permanent crisis than as an adaptation mode (Berry & Kim, 1988; Marsella & Dash-Schreuder, 1988). At the group level, established patterns of authority, civility and welfare do no longer operate; and, at the individual level, hostility, uncertainty, identity confusion and depression frequently emerge. The adaptation outcome, that can be less or more successful, is a function of a set of interacting cultural and psychological variables (Kealy, 1989; Kleber, Brom, & Defares, 1992).

Rapid cultural change has been found to be associated with social disintegration and with an increased incidence of psychiatric symptoms (Leighton, 1974; Leighton, Clausen, & Wilson, 1957; H. Murphy, 1965; J. Murphy, 1976).

Degradation of the environment and westernization are distal, complex processes that are intertwined in the Sahel countries. It is difficult to unravel this process in proximal (psychological) counterparts. Thus, westernization has been shown to include a wide variety of psychological variables such as education and roles (Inkeles & Smith, 1974). The consequences of degradation may be equally variegated, ranging from a loss of the traditional hunter role of males to a change of diet patterns due to a shortage of proteins.

A few studies explored psychological effects of a sudden loss or threat of loss of essential elements of daily life such as means of subsistence or traditional ways of life. In a follow-up of a study of Chance and Cawte in the 1970s, Berry, Wintrob, Sindell, and Mawhinney (1982) studied the Cree 10 years after a hydroelectric dam had been built in their living area. The relationships obtained in the follow-up study replicated the pattern earlier found: Stress and marginality correlated positively with separation attitudes and negatively with integration and assimilation attitudes.

Carry and Weston (1978; see also Giesen, 1991) studied reactions of agriculturalists in Australia to a sudden and serious drop of income. After three financially prosperous years, the Australian dairy sector was hit in 1973 by a high inflation, a fierce decline of the meat prices in 1974, and a collapse of the prices of milk powder on the international market in 1976. The agriculturalists experienced considerably more stress and hostility than a control group of non-agriculturalists. Several agriculturalists suffered from anxiety and depression. Individual differences in stress could not be accounted for by income differences; rather, high stress levels were present among agriculturalists who reported feeling not being able to meet the expectancies of themselves or persons in their environment.

Lumsden (1975) examined psychological consequences of the construction of the Akosombo Dam (Ghana) and the creation of Lake Volta, the largest lake ever made by people. About 80,000 people had to be resettled in 52 new villages. These people had to deal with various stressors, such as loss of jobs, leaving the ground of their ancestors, moving to new and smaller houses, being forced to mix with other cultural groups and facing hostility of these cultural groups. After resettlement, Lumsden found an increase in the four indicators that, according to Naroll (1970), show that a group is under high stress: suicides, alcoholism, provocative manslaughter and witchcraft.

A psychological phenomenon that is frequently studied as an important determinant of how people deal with stress is coping (e.g. Amirkhan, 1990; Lazarus & Folkman, 1984; Parker & Endler, 1992). Cox (1987, in Cox & Ferguson, 1991) defines *coping* as 'the cogni-

tions and behaviours adopted by the individual, following the recognition of a stressful transaction, that are in some way designed to deal with that transaction' (p. 19). The central role of cultural factors in coping is well-acknowledged: 'Cultures emerge and develop as part of the human effort to adapt to a particular socio-economic environment. Culture is coping!' (Marsella & Dash-Schreuder, 1988, p. 168). Coping behaviours displayed by individuals can be captured by a small set of basic styles (e.g. Endler & Parker, 1990). Lazarus and Folkman (1984) identify two kinds of efforts to deal with a stressful event: problem-focused and emotion-focused coping. *Problem-focused coping* refers to active efforts to change stressful circumstances in some way (e.g. getting a second job when the income is too low). *Emotion-focused coping* involves efforts to control one's emotional responses to a stressful event and to change its meaning.

Parker and Endler (1992) propose three dimensions of coping. The first involves task-oriented strategies, such as behaviours aimed at solving a particular problem, cognitively reconceptualizing it or minimizing the effect of the stressor. The second refers to emotion-oriented strategies, such as emotional responses, self-preoccupation or fantasies. The third refers to avoidance strategies, such as engaging in substitute tasks or distracting activities, or seeking out other people (social diversion). They mention social support as a resource for coping rather than as a coping mechanism or style. Amirkhan (1990) developed a questionnaire tapping three coping dimensions: problem-solving, seeking social support and avoidance (e.g. fantasizing and looking for distractors).

With a few notable exceptions (Marsella, Escudero, & Gordon, 1972; Slavin, Rainer, McCreary, & Gowda, 1991), there are no non-western studies of coping (Berry et al., 1992; Lee & Newton, 1981). As a consequence, the cultural bias that may be present in the conceptualization, theory or assessment of coping has not yet been scrutinized.

Locus of control, another important psychological variable in stress research, has been more extensively studied from a comparative perspective. Locus of control 'is based on the belief that outcomes (reinforcements) are either

due to personal factors (internality) or caused by factors external to the individual (that is, fate, chance or significant others)' (Cox & Ferguson, 1991, p. 17). Individuals in western countries are on average more internal than those in the Far East; persons in developing countries are less internal than those in industrialized countries; men tend to be more internal than women across the globe; finally, internally oriented individuals tend to be more achievement-oriented than externally oriented individuals (Berry et al., 1992; Dyal, 1984).

In North American groups Rotter's (1966) measure of locus of control, the I-E scale, often shows two factors: personal control (luck-fate) and social-system control. However, the factor analytic structure is not stable across cultures (Dyal, 1984). A factor analysis of the responses of 170 Brazilian women to the Portuguese version of the I-E scale uncovered two factors: one close to the internal versus external control, while the other was termed *fatalism*, referring to a sense of definiteness of things and to the view that the world is ruled by powerful others (Nagelschmidt & Jakob, 1977). Niles (1981), administering the I-E scale in Sri Lanka, found two factors: fatalism and powerlessness. Jones and Zoppel (1979) found different factors in samples of African Americans from middle and lower class, and a sample of middle-class African Jamaicans. The factors did not resemble those found by other researchers.

Two kinds of explanations for the lack of cross-cultural stability can be envisaged. First, cultural bias can be present in the conceptualization or assessment of locus of control. Locus of control could be too broad a concept to be universally applicable. The feeling of control could be associated with different states and behaviours across cultures, thereby challenging the construct validity of measures that are applied in different cultural groups. Rothbaum, Weisz, and Snyder (1982) introduce a distinction between primary and secondary control. In primary control individuals act upon and change their environments whereas in secondary control persons accommodate to conform to existing realities. In this view locus of control resembles coping; primary control is related to problem-focused coping and secondary control to emotion-

focused coping. Cultural groups could differ in their preferred type of control.

One study found significant cultural differences in the coping styles of children in the United States and Mexico, with US subjects more likely to attempt to master stressful situations actively (Diaz-Guerrero, 1979). Mexican children are socialized to adopt a more passive style of coping with events, modifying themselves rather than confronting obstacles in the environment, while US children are encouraged to take an active approach, modifying their physical, social and interpersonal environments.

Second, most cross-cultural comparisons of locus of control scores are statistically flawed. There are two procedures to compare the structure of scales across cultures: first, an exploratory factor analysis followed by a target rotation and the computation of factorial congruence (e.g. Barrett, 1986; MacDonald, 1985); and second, multisample confirmatory factor analysis (e.g. Jöreskog & Sörbom, 1993; Van de Vijver & Harsveld, 1994). The first procedure is often carried out inadequately (e.g. no target rotation is carried out or unacceptably low coefficients of factorial congruence are treated as evidence of invariance, cf. Bijnen, Van der Net, & Poortinga, 1986). Furthermore, differential item-functioning techniques (Holland & Wainer, 1993) are never applied. These shortcomings complicate the interpretation of research findings reported. Yet, it is quite unlikely that the massive cross-cultural differences in factorial structure reported should be accounted for entirely by these shortcomings.

A theoretical framework to understand psychological consequences of land degradation and westernization is not available. This article will describe a first attempt to develop such a framework, based on field research in Burkina Faso. Psychological correlates of environmental degradation are studied among two groups of Sahel dwellers, namely the Mossi (agriculturalists) and the Fulani (pastoralists). The Mossi are sedentary farmers, growing millet and sorghum as staples. Their kinship system is patrilineal and virilocal. Married Mossi women have an inalienable right on land use in the village of their husband. Mossi agriculture heavily depends on labour of the women.

Some groups of artisans, such as smiths and leather workers, belong to disdained castes. Mossi society, which is organized on the basis of a feudal kingdom, is divided into royalty, nobles, commoners and, formerly, slaves. Each village is governed by a chief who, in turn, is subordinate to a divisional chief. At the top of the hierarchy is the paramount ruler, the *morho naba* ('big lord'), whose seat is at Ouagadougou. The villages are composed of quarters based on localized lineage segments. Access to land is religiously mediated by the 'chef de terre' (earth priest), the eldests of the first arrived lineages. The first arrived lineages still authorize on matters of access to land, also to the Fulani.

The Fulani are a mainly pastoral people; their lives and social organization are dominated by the needs of their herds. The social structure of the pastoral Fulani was originally egalitarian, in marked contrast to that of other Muslim groups. The influence of Islam on kinship patterns is evident in the general preference for cousin and other intralineage marriages. Most men are polygamous, the typical household unit comprising the family head, his wives, and unmarried children (*The New Encyclopaedia Britannica*, 1983). Fulani women have their own cattle and are entitled to commercialize the milk and its products of the whole herd. The Fulani are dispersed within the kingdom of the Mossi and are locally organized in settlements (*wuro*) which may or may not be attached to a Mossi village (Riesman, 1974). In case of conflicts on crops or cattle a Fulani chief (*Jooro*) negotiates with the Mossi responsables. But in general Fulani men negotiate individually with Mossi farmers. The overall exploitation pressure on natural resources was high for a long period of time and still lingers on, despite a considerable degree of emigration. As a consequence of these dynamics of man-environment interactions, the former symbiosis between agriculturalists (Mossi) and pastoralists (Fulani) is gradually being put under more and more pressure (Lekanne dit Deprez, 1995, p. 38).

The Mossi and the Fulani are studied in two regions, one with a low though rapidly progressing degradation and one with a high degradation. The design of the study is based on a natural 2 × 2 crossing of cultural group and

degree of environmental degradation that is unique to this area. The psychological consequences of degradation that will be investigated are stress and marginalization. These variables will be related to a set of psychological variables, namely modernity, locus of control and coping, and background variables such as occupation, education and degree of environmental degradation.

Method

Locations

Two areas of research were chosen with a different availability and current condition of natural resources: the Kaya and the Manga region, both in Burkina Faso. In the Kaya region the soil degradation is stronger and has already led to the migration of agriculturalists. The higher pressure on natural resources was confirmed by soil scientists and biologists working in the area (Kessler & Geerling, 1994). In Kaya the temporary migration of 'Les Jeunes' (i.e. young men between 18 and 45 years) was more and more needed to support their families. Migration was often experienced as a threat because of the loss of manpower and the danger that the young men might return ill. AIDS was seen as a potential threat, but local psychiatrists also mentioned migration-related mental illnesses (personal communication, June 9, 1992, with Chiaka Diakité, chef du projet Centre Régional de Médecine Traditionnelle in Bandiagara, Mali, and some colleagues).

Two villages were randomly chosen in the region of Kaya: Tagala and Kiemna. Data were collected in cooperation with a regional Dutch development project and a Burkina Bé resource person who introduced the study to the participants.

In the region of Manga pressure on natural resources was much less, as apparent from land degradation indicators (Kessler & Geerling, 1994). There was still an influx of agriculturalists and pastoralists from regions with a higher land degradation. The subjects in our samples had not recently migrated and lived in the area for at least 10 years. Here, too, the research was carried out in cooperation with Dutch development workers and a Burkina Bé resource person. Two villages, Sondre-est and Barce, were randomly chosen.

Participants

The sampling of persons was done in a fairly random way, in consultation with the village chief and the resource person. In most cases more than half the inhabitants were interviewed. When this was not the case, we chose living areas that were representative for the whole village. A total of 579 (322 men, 257 women) persons were interviewed, of whom 303 in the region of Kaya and 276 in the region of Manga (Table 1). There were 402 in the Mossi ethnic group and 160 in the Fulani ethnic group; 17 were of other ethnic origin.

Table 1. Number of participants per region, profession and cultural group

Region	Profession	Cultural group	
		Fulani	Mossi
Kaya	Agriculturalists	—	186
	Pastoralists	103	—
Manga	Agriculturalists	—	216
	Pastoralists	57	—

Of the informants 333 were Moslems, 145 were Christians, 99 were animists; 1 person was atheist (1 missing case). The vast majority of the participants were illiterate; 509 persons had no or little education, 36 persons could read and write (34 missing cases).

Instruments

Information about various questions about the background of the respondents was asked: age, ethnic group, gender, number of adult women in the same household (both cultural groups are polygamous), education, religion, household size (operationalized as the number of individuals regularly having food from the same kitchen as the participant), organizational membership, sources of income and cattle owned (operationalized as the number of cows plus one-quarter of the number of the other cattle such as goats, sheep and donkeys).

Coping was assessed with Amirkhan's (1990) Coping Strategy Indicator. This questionnaire was chosen because of its stable factorial structure in a cross-cultural study, involving 11 nations (Poortinga et al., in preparation). The questionnaire consists of 33 possible coping behaviours, with three response alternatives ('a

lot,' 'a little' and 'not at all') indicating the extent to which the subject has displayed the behaviour after a stressful event mentioned before by the subject. The item 'watched more television than usual' was omitted since no subjects in our sample had electricity in their houses. The item was replaced by 'visited markets more than usual'. A question on television watching was dropped.

Locus of control was assessed with the Spheres of Control (SOC) of Paulhus (1984), that consists of three 10-item scales, the Personality Efficacy Scale, Interpersonal Control Scale and the Sociopolitical Control Scale. The subject has to indicate whether he or she agrees or disagrees with each item. The questionnaire was chosen because of its broad coverage.

Marginality was measured with Mann's (1958) 14-item scale. A short 20-item version of the general symptom checklist SCL-90 (Derogatis, 1977) was administered to assess stress.

Translation of the questionnaires and training of the interpreters

The English questionnaire was first translated into French and backtranslated. The French versions were then translated by the interpreters into the languages of the ethnic groups. The questionnaires were backtranslated from the languages of the ethnic groups into French.

A four-day training was given to five Mossi interpreters (three men and two women) and two Fulani interpreters (one man and one woman). Respondents were nearly always interviewed by interpreters from their own ethnic group. Interviewer and interviewee were always of the same gender because in a pilot study it was found to be impossible to have women interviewed by men.

Statistical analyses

The statistical analyses were split up in three parts. The first one involved the psychometric properties of the instruments and factor analyses to scrutinize their construct validity. In addition, a factor analysis was carried out on the background questionnaire aiming at a reduction of its dimensionality. In the second part differences in average scores on the psychological variables were tested in analyses of variance, with gender, cultural groups and the areas of degradation as

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independent variables. Finally, a model of the relationship between the background data and coping and locus of control as input variables and stress and marginalization as output variables was developed using structural equation modeling.

Results

Factor analyses

The following questions of the background questionnaire were factor-analyzed: primary means of subsistence, organizational memberships, age, number of women, household size and number of years of education. In addition, religious denomination was included. Animism (as the more traditional religion) was scored as 0 while Islam, Christianity and atheism (as less traditional) were scored as 1. An eigenvalue-larger-than-one criterion and an adequate interpretability of the solution pointed to a two-factor solution, with eigenvalues of 1.62 and 1.17, together explaining 39.9 percent of the variance. The Varimax-rotated factor loadings are presented in Table 2. The first factor showed high loadings for household size, age and a fairly high loading for the number of women. The factor was interpreted as status in the community. The kind of religion and years of education were the highest loading variables of the second factor. The factor was labelled modernity.

The reliability coefficients (Cronbach's α) were computed per cultural group (see Table 3). The coping and stress questionnaires yielded rather high values (ranging from .70 to .82); the reliability of the marginalization questionnaire was reasonable, with values of .62 and .67 for the Mossi and the Fulani data, respectively. The reliability of the locus of control scale was low, with values of .50 for the Mossi and .45 for the Fulani. Tests of the equality of the reliability coefficients in the cultural groups did not show significant values ($\alpha = .01$ throughout the article).

Confirmatory factor analyses of the measures

Table 2. Varimax-rotated factor loadings of the background variables

Variables	Factor	
	Status	Modernity
Household size	.74	.02
Age	.69	-.14
Number of women	.46	-.32
Means of subsistence	-.02	.31
Membership of organizations	.44	.33
Kind of religion	-.32	.57
Years of education	.11	.77

of coping, locus of control, stress and marginalization measures were carried out to test whether the structure observed in western subjects could be replicated. The first analysis addressed coping. Amirkhan (1990) found a three-factorial structure of data of US adults. Each item showed a high loading on one factor in the US group. This loading was defined as a free parameter in the analysis; remaining loadings (two for each item) were fixed at zero. Factors were allowed to correlate (which was not the case in Amirkhan's analysis). The fit of the data was poor ($\chi^2 = 1569.23$; $df = 461$, $p < .001$; Root Mean Squared Error of Approximation (RMSEA) = .07; Adjusted Goodness of Fit Index (AGFI) = .83; Tucker-Lewis Index (TLI) = .66). Modification indices of several loadings were large; there was no clear patterning of these indices. Moreover, the first two factors showed a correlation of .75. It can be concluded that the three-factorial structure as obtained in the US was not replicated here.

The second analysis addressed the Spheres of Control Scale which has three subscales. Each item had a free loading on the presumed target factor and fixed zero loadings on the other two factors. Factors were allowed to correlate. The fit of the data was poor ($\chi^2 = 1647.14$; $df = 402$, $p < .001$; RMSEA = .07; AGFI = .78; TLI = .34). Many items revealed large modification indices; all factors were strongly correlated.

Table 3. Reliabilities of the psychological measures per cultural group

Cultural group	Locus of control	Coping	Marginalization	Stress
Mossi	.50	.72	.62	.82
Fulani	.45	.70	.67	.82

Obviously, the use of the three factors is not fruitful for these data.

The stress questionnaire is assumed to measure one underlying factor. A confirmatory factor analysis postulating one factor with free loadings showed a poor fit ($\chi^2 = 791.86$; $df = 170$, $p < .001$; $RMSEA = .08$; $AGFI = .82$; $TLI = .70$). A similar procedure was followed for the marginalization and again, a poor fit was observed ($\chi^2 = 357.07$; $df = 77$, $p < .001$; $RMSEA = .08$; $AGFI = .87$; $TLI = .63$). It can be concluded that none of the four ques-

tionnaires replicated the western factorial pattern.

The presumed deviance of the western pattern was further scrutinized using exploratory factor analysis. A two-factorial solution of the coping questionnaire, that explained 24.5 percent of the variance, was chosen because of its interpretability (see Table 4). The first factor is a combination of (in terms of Amirkhan's factors) problem-solving items and most support-seeking items. The second factor was a combination of avoidance behaviours and four items of the

Table 4. Varimax-rotated factor loadings of the items of the coping strategy indicator

Item	<i>F I</i>	<i>F II</i>
Let your feelings out to a friend	.68	
Rearranged things around you	.75	
Brainstormed all possible solutions	.72	
Tried to distract yourself from the problem	.39	
Accepted sympathy and understanding		(.23)
Keeping others from seeing how bad things were		-.52
Talking to people about the situation	.64	
Set some goals for yourself	.28	-.27
Weighed your options very carefully	.57	
Daydreamed about better times		(.24)
Tried different ways to solve the problem	.59	
Confided your fears and worries to a friend	.69	
Spent more time than usual alone		(-.20)
Talking to generate solutions	.64	
Thought about what needed to be done	.42	
Turned full attention to solve the problem	.14	
Formed a plan of action in your mind	.58	
Visited markets more than usual		-.34
Went to someone	.59	
Stood firm and fought		-.26
Avoided being with people in general		-.33
Buried yourself in a hobby or sports		-.47
Went to a friend to feel better	.61	
Went to a friend for advice	.57	.27
Accepted sympathy and understanding		.31
Slept more than usual		-.51
Fantasized about how things could have been different		.41
Tried to solve the problem	.31	
Wished that people would leave you alone		.41
Accepted help from a friend or relative		.35
Sought reassurance		.29
Tried to plan carefully a course of action		(-.15)

Note: *F I* = Intentional coping (problem-focused solving); *F II* = Intra-individual coping (emotion-focused coping). Loadings with an absolute value smaller than .25 are omitted. For some items (the absolute value of) the highest loading on either factor was smaller than .25. For these items the highest loadings are given in parentheses.

support-seeking scale. These were the items that started with the word *accepted* and the item 'sought reassurance from those who you know best'. The split of the support-seeking factor can be interpreted as a separation of the more problem-oriented items going to the first factor and more person-oriented items going to the second factor. The first factor refers to intentional, active coping, the second factor to dealing with intra-individual consequences. The distinction between the two factors bears a close resemblance to Lazarus and Folkman's (1984) concepts of problem-focused and emotion-focused coping.

A remarkable feature of the second factor, not present in Amirkhan's original data, is its bipolarity. The highest positive loadings were obtained for 'wished that people would just leave you alone', 'fantasized about how things could have been different' and 'accepted help from a friend or relative'; the strongest negative loadings were found for 'keeping others from seeing how bad things were', 'slept more than usual' and 'buried yourself in a hobby or sports'. The items with strong negative loadings describe more active avoidance behaviours than do the items with positive loadings.

The structure underlying of the Spheres of Control Scale was also further examined in an exploratory factor analysis. The eigenvalues of the first five factors were 3.16, 2.33, 2.21, 1.69 and 1.43. Both a scree-test and the number of underlying scales suggested the extraction of three factors, explaining 25.7 percent of the variance. However, there was no correspondence with the three scales found in western subjects (Lefcourt, 1982; Paulhus, 1984). The number of discrepancies between the expected and obtained loadings on the three factors is striking and does not support the construct validity of the three scales in the present groups.

Furthermore, the three-factorial solution was difficult to interpret. The first factor contained items that describe individual effort such as 'I get what I want when I work hard for it' and 'my accomplishments are due to hard work and intelligence'. The second factor could be tentatively labelled 'non-personal control', with items such as 'I prefer games' and 'I concentrate on things other than solving the world's problems.' The highest loadings on the third factor were obtained for items of the Sociopolitical Control Scale, but

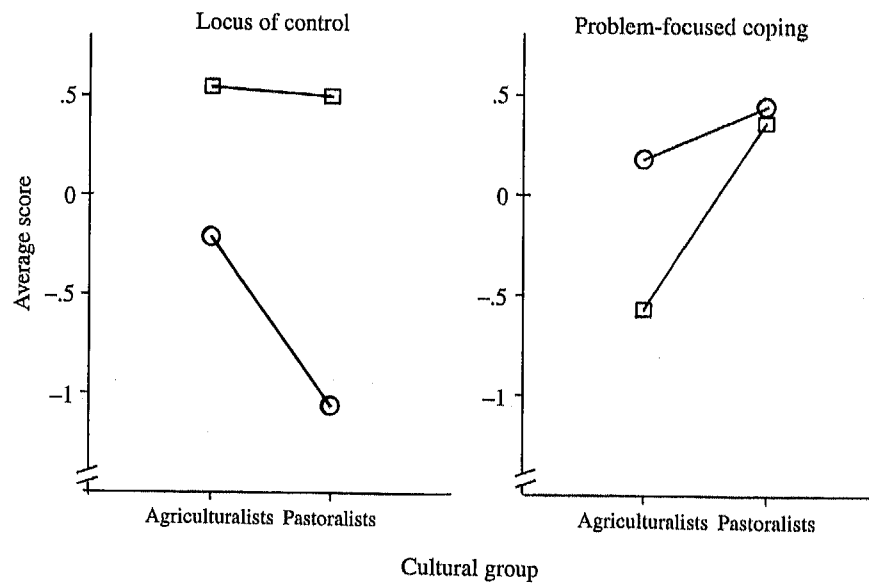
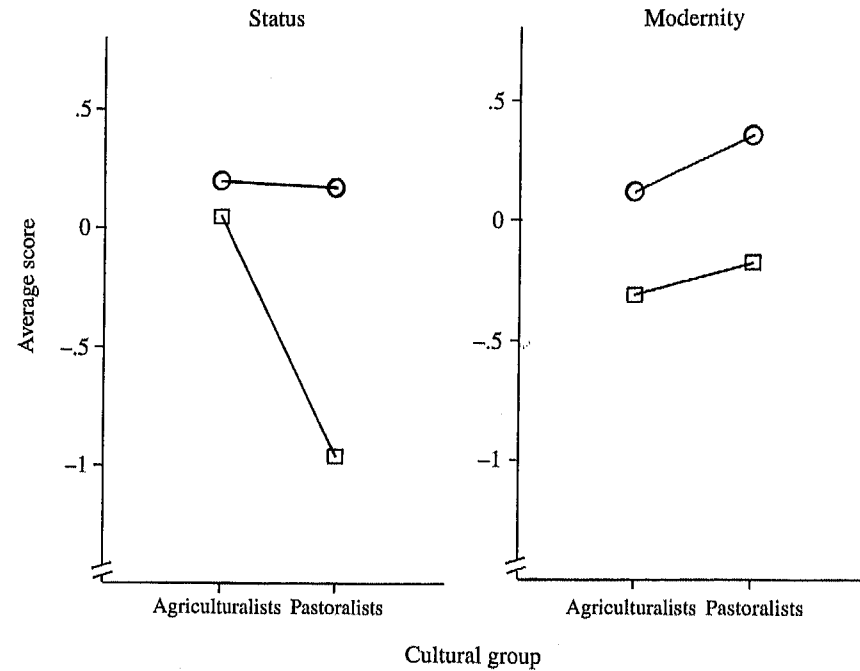
several items of the other two scales also showed substantial loadings, producing a non-interpretable clustering of items. Solutions with other numbers of factors did not produce interpretable factors either. The results of both the confirmatory and exploratory factor analysis replicate the often-observed lack of generalizability of the structure of western groups across in non-western groups (Dyal, 1984). The common practice was adopted here to utilize the total test score in the remainder of the analyses.

A factor analysis of the SCL-90 revealed a strong unifactorial structure; the first factor explained 24.9 percent and the second 9.9 percent of the variance. A scree-test of the eigenvalues of the marginality questionnaire also pointed to a unifactorial structure; the first factor explained 21.1 percent and the second factor 11.5 percent of the variance.

In sum, the structures presumably underlying the questionnaires could be better retrieved in exploratory factor analyses than in confirmatory factor analyses. For two questionnaires, marginality and stress, the factorial structure obtained among western subjects could be confirmed; for coping the structure could be partially replicated and for locus of control the structure in the present sample differed substantially from what has been reported in western groups.

Analyses of variance

The second part of the statistical treatment of the data consisted of analyses of variance, with cultural group (profession), gender and living area (as a proxy for severity of degradation) as independent variables, each with two levels. The dependent variables were factor scores on status, modernity, both coping factors, stress and marginalization and the total test score on locus of control. Table 5 presents the proportion of the total variance accounted for by each source of variation. The independent variables that most frequently yielded significant effects were cultural group and gender. Mossi individuals were found to be lower on modernity and problem-focused coping, and higher on status, emotion-focused coping, stress and marginalization than were Fulani individuals. Furthermore, women were more externally oriented, lower on status, modernity, marginalization and problem-focused coping, and higher on emotion-focused coping and stress than men were (see Figure 1).



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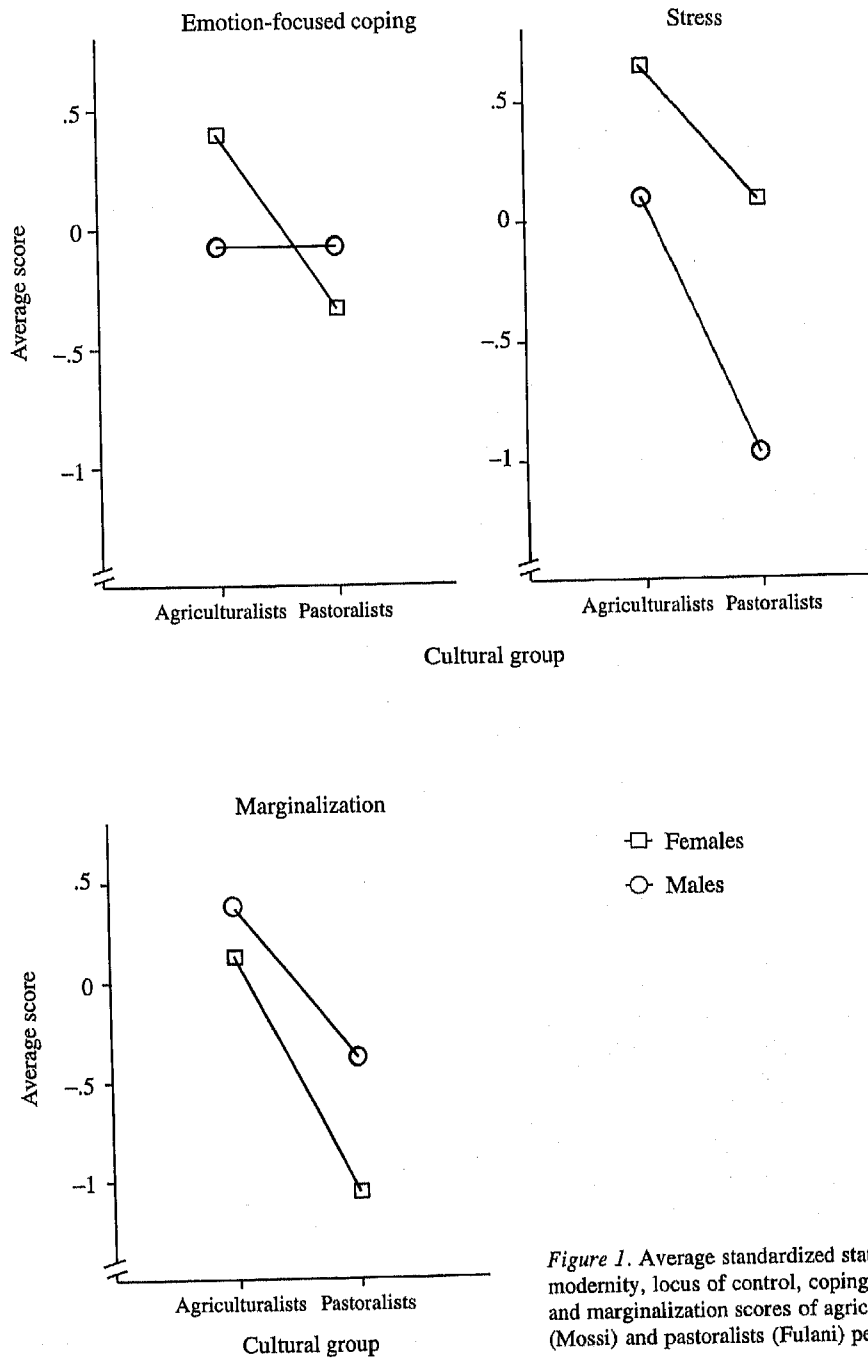


Figure 1. Average standardized status, modernity, locus of control, coping, stress and marginalization scores of agriculturalists (Mossi) and pastoralists (Fulani) per gender.

Table 5. Proportion of total variance per effect in analyses of variance, with the major psychological variables as dependent variables and cultural group, gender, and severity of degradation (area) as independent variables

Dependent variable	Effect						
	C	G	A	C × G	C × A	G × A	C × G × A
Status	.04	.04	—	.04	.03	—	.01
Modernity	.01	.05	—	—	—	—	.02
Locus of control	.05	.24	—	.03	—	—	.02
Problem-focused coping	.06	.08	.02	.02	—	—	—
Emotion-focused coping	.03	.02	.02	.04	—	—	—
Stress	.12	.12	.02	—	.05	—	—
Marginalization	.14	.09	.02	—	.01	—	—

Note: C = Cultural group; G = Gender; A = Area (degree of degradation). Dashes refer to non-significant effects ($p > .01$).

Severity of environmental degradation showed a main effect for both coping measures, stress and marginalization. The effect of area tended to be much smaller than the effects of the other independent variables, gender and cultural group. Individuals living in the area with less degradation (but a higher rate of progress of the process) scored lower on problem-focused coping and higher on emotion-focused coping, stress and marginalization than did individuals in the more degraded area. This might be due to the rapid progress of the degradation process in the former region and to a sizeable migration stream of presumably marginalized individuals from the more to the less degraded region.

Status, locus of control, and both coping scores showed a significant interaction of gender and cultural group; the interactions for status and locus of control reflected the larger gender differentiation in scores among the group of Fulani; for both coping scores the differentiation was smaller in the group of Fulani. The nomadic (Fulani) women may have scored higher on problem-focused coping than the sedentary (Mossi) women did because they are able to generate their own income by working and selling cattle products like milk relatively independently. The tight relations within the agriculturalists' society leaves less opportunity to problem-focused coping, especially for women. The high scores on emotion-focused coping seem to indicate that Mossi women perceive events as uncontrollable. This is in agreement with western findings on gender differences in coping; thus, Thoits (1987, 1991) found a relationship between coping style and social

position. Problem-focused coping is preferred when persons feel responsible and perceive that they are able to control the situation while emotion-focused coping is used when the situation is perceived as uncontrollable.

No interactions of gender and severity of environmental degradation reached significance. The triple interactions were significant for three dependent variables; in each case the proportion of the variance explained by the triple interaction was small.

LISREL analyses

The third part of the statistical analyses examines the relationship among profession, status, modernity, environmental degradation, number of cattle owned, locus of control and coping as input variables and stress and marginalization as output variables in a covariance structure analysis. In preliminary analyses it was found that status, locus of control and both types of coping did not show any substantial relationship with both dependent variables; hence, these variables were dropped.

The input and output variables were linked in a so-called MIMIC model (*Multiple Indicators Multiple Causes*). This model was chosen because it corresponds with our theoretical framework in which the psychological processes accompanying environmental degradation (the output variables) are taken to be variegated and to be influenced both by ecological and psychological sources (the input variables); a regression or path analysis with merely observed variables would allow studying only specific relationships between input and output variables.

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As women and men showed such large score differences in the analyses of variance, it was decided to fit separate MIMIC models for these groups. The latent variable was labelled *carrying capacity*. This concept, originating in psychiatry and ecology, is often applied in systems theory to describe the change in adaptability of a system after a substantial increase of the carrying load. Overload can lead to disintegration and even a complete breakdown of the system. In this article stress and marginalization are seen as the consequences of the diminished carrying capacity.

The hypothesis of equal covariance matrices of men and women of the four input variables (land use, environmental degradation, cattle and modernity) and two output variables (stress and marginalization) had to be rejected ($p < .001$, see Table 6). A set of hierarchically nested MIMIC models was then fitted to the data. The loading of stress on carrying capacity was fixed at -1 in order to make the model identifiable. The analysis with the least restrictive MIMIC model postulated the same structure of four input and two output variables without any equality constraint on the estimated parameter values for women and men. This model yielded a fair fit; the overall χ^2 test was not significant ($\chi^2 = 11.21$, $df = 6$, $p = .08$). A model with equal Λ matrices (i.e. loadings of marginalization on carrying capacity) showed a significant overall fit value ($\chi^2 = 19.07$, $df = 7$, $p < .01$), a significant $\Delta\chi^2$ ($\Delta\chi^2 = 7.86$, $df = 1$, $p < .01$), and moderately adequate values of .89 for the TLI and of .06 for the RMSEA. Taken together, these statistics point to a rather poor fit of the data to the model. Additional

restrictions of equality of the Γ (regression weights of the independent variables on carrying capacity) and Ψ^2 matrices (the error variance of carrying capacity) to be equal for men and women, showed the same pattern of results: a significant overall fit test, non-significant $\Delta\chi^2$ -values, and acceptable values of the TLI and RMSEA (see Table 6). When equality of the error variances of stress and marginalization was introduced, the value of $\Delta\chi^2$ was significant ($\Delta\chi^2 = 10.15$, $df = 2$, $p < .01$), pointing to a serious loss of fit. In sum, a good fit was found for a model postulating the same MIMIC structure for women and men without equality constraints on the parameters for across sexes; the introduction of such constraints yielded a significant loss of fit.

The estimated parameter values of the MIMIC models for women and men as well as those of the most restrictive MIMIC model are presented in Figure 2 (the latter is given for reference). The most salient gender differences were found for the right side of Figure 2. The relationships between carrying capacity and marginalization were dissimilar for women and men. Carrying capacity was more strongly associated with marginalization for women and with stress for men. Also, the variance in stress explained by the model was substantially different for women and men (28 percent and 48 percent, respectively).

The differences in path coefficients (the influence of the independent variables) between women and men were not large, as shown by the non-significant increase of $\Delta\chi^2$ when these coefficients were set equal. The most influential independent variable was land use, that is

Table 6. Fit indices of tests of the equality of the MIMIC for women ($N = 243$) and men ($N = 298$)

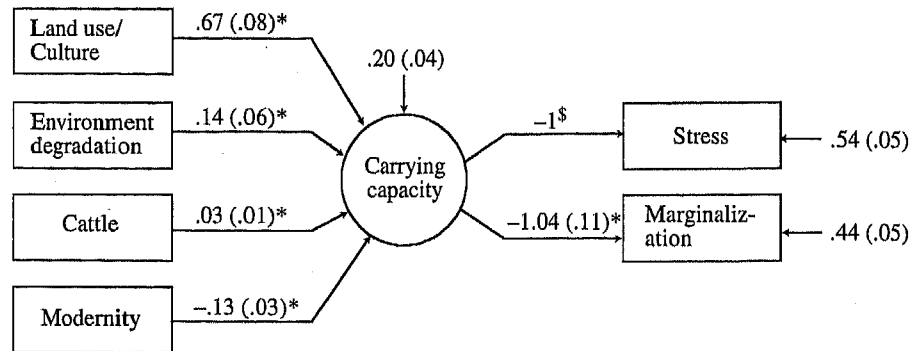
Model	χ^2	df	prob.	$\Delta\chi^2$	prob.	TLI	RMSEA
Equal covariance matrices	132.08	21	.000*				
Incremental models							
No equality constraints ^a	11.21	6	.082			.95	.04
Equal Λ s	19.07	7	.008*	7.86	.005*	.89	.06
Equal Λ s and Γ s	25.04	11	.009*	5.97	.201	.92	.05
Equal Λ s, Γ s, and ψ s	27.02	12	.008*	1.98	.159	.92	.05
Equal Γ s, ψ s, Λ s, and Θ_{ϵ} s ^a	37.17	14	.001*	10.15	.006*	.90	.06

Note: TLI = Tucker-Lewis Index; RMSEA = Root Mean Square Error of Approximation.

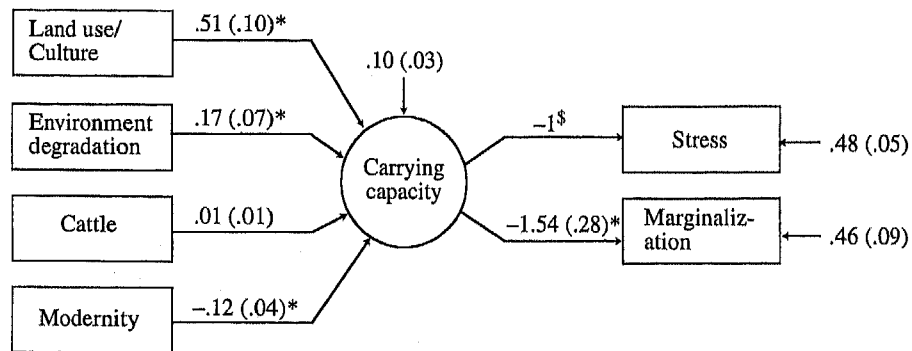
^a Parameters of the model are given in Figure 2. * $p < .01$.

MIMIC models:

(a) Women and men combined



(b) Women



(c) Men

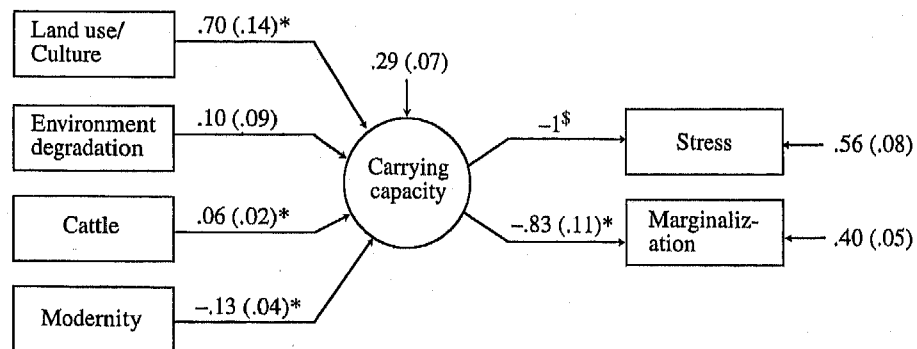


Figure 2. MIMIC model of carrying capacity for (a) the whole sample, (b) women and (c) men. * $p < .01$;
^{\$} The loading of stress on carrying capacity was fixed.
 Note: Scores of cattle were divided by 10. The parameters of the combined sample are based on equality of the Γ , ψ^2 , Λ and Θ_e matrices for women and men.

equivalent here to profession and membership of cultural group. The pastoralists (Fulani) have on average a larger carrying capacity than do the agriculturalists (Mossi).

Women in more degraded regions tended to have a larger carrying capacity; the relationship was not significant for men. In the combined sample, the relationship was also significant. These findings are probably due to the high rate of degradation of the less eroded region and the migration into this region.

Cattle had a significant and positive impact on carrying capacity for men; the relationship was not significant for women. The positive influence among men may seem unexpected as overgrazing is one of the major reasons for environmental degradation. In our view the 'Tragedy of the Commons' provides an adequate framework to understand this quasi-paradox (Hardin, 1968). On an individual level, having more cattle leads to a higher means of subsistence and social security for the person and his or her family whereas on the population level, having more cattle leads to more overgrazing and degradation of the physical environment. It is interesting to note that cattle also showed a highly significant correlation ($r = -.30$) with locus of control. If cattle is viewed as an indicator of socio-economic status, this finding replicates common findings that individuals from a high socio-economic status tend to be more internally oriented (Berry et al., 1992; Dyal, 1984).

Modernity had a negative influence on carrying capacity for both women and men. More modern individuals tended to have less carrying capacity and to experience more stress and marginalization. More modern and more traditional methods of farming are both practised in the region. Neither method has been able to stop or reverse the degradation process. It is quite likely that this led to more stress and marginalization among more modern agriculturalists. They had adopted more western ways of farming to deal with the environmental challenges. However, in many respects there is a discrepancy between individual and national change. For instance, the traditional land property laws (that are not based on individual ownership) are not compatible with modern farming. These property laws are also changing, but individual changes often take place much quicker.

Discussion

Environmental degradation has important psychological components, some of which were examined in this article. A model was fitted to the data postulating a relationship among four input variables (*culture, environmental degradation, cattle and modernity*), a latent variable (called *carrying capacity*) and two output variables (*stress and marginalization*). For both men and women an adequate fit was found, with slightly different estimated parameter values for each sex. Pastoralists showed a higher carrying capacity than did agriculturalists. Higher levels of modernity led to lower levels of carrying capacity. Furthermore, women in the more degraded region showed a higher level of carrying capacity; for men, the relationship had the same sign but was not significant. Finally, having more cattle gave rise to more carrying capacity for men, while the relationship was not significant for women.

Confirmatory factor analyses of the psychological measures invariably pointed to a poor replicability of the structure obtained in western samples among the Mossi and Fulani. Exploratory factor analyses yielded a more diverse picture. Unifactorial structures of the marginality and stress data were found; this replicates findings obtained among western subjects. The lack of replicability of Amirkhan's factorial structure, obtained among US adults, may be explained by viewing the factors as behaviour alternatives. Problem-solving and support-seeking do not constitute separate strategies for Mossi and Fulani individuals. They live in tightly knit, extended families and their coping behaviour will often include both options. The distinction between problem-focused and emotion-focused coping might better reflect the behavioural alternatives in the coping process. It is also possible that cultural bias is present in the theory or assessment of coping; the bias is difficult to assess due to the limited number of cross-cultural studies on coping (Berry et al., 1992; Lee & Newton, 1981).

The lack of replicability of the Spheres of Control Scale (Lefcourt, 1982; Paulhus, 1984) is striking. The present findings do not support the construct validity of the three scales in the present groups. Our findings are in line with the often-observed lack of replicability of factors of

locus of control scales found in groups of western subjects in non-western groups (Dyal, 1984; Jones & Zoppel, 1979; Niles, 1981; Trimble & Richardson, 1982).

The problems with the assessment of coping and locus of control should not obscure the relevance of the concepts for carrying capacity. We found for both sexes that locus of control and problem-focused coping showed a significant correlation with marginalization but not with stress. Emotion-focused coping was unrelated to both stress and marginalization for men and women. It is unclear why stress was unrelated to coping and locus of control. It might be due to the skewness and restricted variance of the coping scores; the overall average was 1.48 (possible range: 1–3) and the standard deviation was 0.22, indicating that most individuals agreed with most items. The locus of control scale also showed a skewed distribution.

As another possibility, items of both scales may inadvertently leave out relevant behaviours of Mossi and Fulani individuals. New items or instruments should be more geared to locally relevant aspects of the concepts. For instance, religion may also be related to coping. Religion is not at all covered by the current avoidance factor. The relevance of religion in coping has also been pointed out by Hwang (1977, quoted in Cheung, 1986). He found that married men in Taiwan mentioned 'appeals to supernatural powers or prayers for blessings' (p. 203) as an important strategy to deal with daily problems. As for the locus of control scale, the item contents could be formulated in such a way that the relationship with the feeling of control is more obvious. Several items of the current questionnaire have a strong connotation of personal accomplishment instead of perceived control.

The discrepancy between the confirmatory and exploratory factor analyses could be brought about by various factors:

First, statistical-technical factors may be involved (such as a differential susceptibility to assumptions of the techniques such as multivariate normality [cf. Ten Berge, 1986]).

Second, item-level comparisons in cross-cultural psychology are known to be unstable as can be observed in studies of differential item functioning (Holland & Wainer, 1993). Item

particulars such as words or behaviours described may create minor though consistent sources of cross-cultural inequivalence. From a psychological perspective, item inequivalence is poorly understood (Linn, 1993; Scheuneman, 1987).

Third, confirmatory factor analyses may be much more powerful to detect deviations and may show a poor fit even for psychologically trivial model violations. Both in western and non-western populations it may be difficult to find an adequate fit when hypothesized structures are based on items instead of test or subtest scores. This is illustrated in a recent study by McCrae, Zonderman, Costa, Bond and Paunonen (1996). These authors applied a confirmatory factor analysis to fit the Big Five model of personality. Four of the five (and sometimes all five) factors are stable across populations in exploratory factor analyses. However, confirmatory factor analyses postulating five factors showed a poor fit.

It was found that pastoralists were less marginalized and stressed than agriculturalists were. This finding is in agreement with the common observation that nomadic people (the pastoralists) are less susceptible to environmental stressors than are sedentary people (the agriculturalists). Unlike the latter, the former can move away from environmental stressors (e.g. Berry, 1976). The same mechanism may also explain the lower emotion-focused scores and higher problem-focused coping scores of the pastoralists.

Women were more externally oriented, lower on status, modernity, problem-focused coping and marginalization and higher on stress and emotion-focused coping than men were. Measures of status, modernity and locus of control often reveal differences as found here, whereas the gender differences in marginalization and stress may require clarification. In our interpretation, the higher scores of women on stress and the lower scores on marginalization are related to role differentiation. Women in both groups are traditionally more involved in child-rearing and day-to-day work of farming and herding, while men are responsible for hunting, herding and some agricultural tasks like preparing the soil for sowing. Compared to the men, the women presumably have to cope with more, but relatively more easily resolvable, problems such as feeding the children. The women are

still better able to fulfil their traditional roles than are the men, who face many prohibitive rules on hunting and on grazing. Moreover, the men often have to migrate temporarily to urban areas to earn money; the migration creates its problems: the men lose contact with family and children, and the urban environments to which the men migrate are getting more and more hostile (e.g. AIDS). The migration and loss of traditional roles may induce feelings of social insecurity and marginalization among men.

The gender differences varied across the two cultural groups. The higher scores of the Fulani women on problem-focused coping and their lower scores on emotion-focused coping, stress and marginalization than the Mossi women might be caused by the gender role differentiation in the two cultural groups. Fulani women may be under less pressure than Mossi women because of their larger economic independence, which gives them more opportunity to cope.

The present study was a first attempt to develop a model of psychological aspects of environmental degradation. A more comprehensive picture will be obtained in a longitudinal design. Environmental degradation and its psychological aspects form an enduring process with mutual feedback loops. An environment that starts to erode will induce psychological consequences such as stress and marginalization. The psychological consequences can lead to behaviour that will accelerate degradation (e.g. overgrazing) or to behaviour that will effectively cope with the threat of total loss of natural resources. The MIMIC model proposed is unidirectional and assumes that the psychological components of the degradation process have inputs and outputs. However, it is quite likely that with a continuous degradation process, feedback loops will start to develop; for instance, strong feelings of marginalization can give rise to migration and to a more rapid degradation of the environment. It is only through the application of longitudinal designs that the dynamics of the process can be unraveled.

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